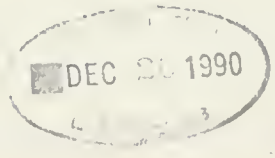

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DETERMINANTS OF ELECTRONIC INTEGRATION IN THE INSURANCE INDUSTRY: AN EMPIRICAL EXAMINATION

Akbar Zaheer
and
N. Venkatraman

Working Paper #3220-BPS
Supercedes # 3165-BPS

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MASSACHUSETTS
INSTITUTE OF TECHNOLOGY
50 MEMORIAL DRIVE
CAMBRIDGE, MASSACHUSETTS 02139

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Determinants of Electronic Integration in the Insurance Industry: An Empirical Examination

Akbar Zaheer

E52-509 MIT Sloan School of Management
Cambridge, MA 02139.
(617) 253-3857

and

N. Venkatraman

E52-537 MIT Sloan School of Management
Cambridge, MA 02139.
(617) 253-5044
Bitnet: NVenkatr@Sloan

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Determinants of Electronic Integration in the Insurance Industry: An Empirical Examination

Abstract

Electronic integration -- a form of vertical integration achieved through the deployment of dedicated computers and communication systems between relevant actors in the adjacent stages of the value-chain -- is an important concept to organizational researchers since it provides a new mechanism for managing vertical relationships. Drawing upon on transaction costs, a set of hypotheses on the determinants of the degree of electronic integration of insurance agencies is tested in a design comprising two independent samples: (a) one with 143 property and casualty (P&C) insurance agencies involved in the *commercial* lines business -- who are interfaced with a single focal carrier *via* a dedicated computer-based system; and (b) a second with a random sample of 64 independent agencies interfaced with insurance carriers for *personal* lines business. The results across both settings did not support the hypotheses, thus raising some theoretical issues on the applicability of the transaction cost model in situations affected by information technology applications. Implications and extensions are offered.

Key Words: Information technology; vertical integration; electronic integration; organizational governance; insurance industry -- commercial lines; personal lines.

Introduction

This paper is concerned with the role of information technology in influencing the pattern of interfirm arrangements in a marketplace. It builds from the extensive body of research on the design of interfirm relationships that lie along a continuum from *markets* to *hierarchies* (Williamson, 1985) to a specific context where such relationships are fundamentally impacted by information technology applications (see for instance, Cash and Konsynski, 1985; Keen, 1986; Johnston and Lawrence, 1988; Rockart and Scott Morton, 1984). Specifically, we are concerned with the relevance and applicability of the transaction costs perspective to understand the pattern of vertical control between insurance carriers and independent agents.[1]

To achieve this objective, we develop a model of electronic integration -- defined as a specific form of quasi-integration within the class of mechanisms for vertical controls -- and derive a set of its determinants from the transaction cost theory that has been recently argued to be relevant for settings impacted by information technology (Bakos and Treacy, 1986; Malone, Yates, and Benjamin, 1987; Clemons and Row, 1989); more specifically, interorganizational information systems (IOS). This model is tested using a research design comprising two independent samples: (a) 143 property and casualty (P&C) agents dealing with *commercial* lines -- who are interfaced with a single focal carrier *via* a dedicated computer-based system; and (b) a second with a random sample of 64 independent agents interfaced with insurance carriers for *personal* lines.

Theoretical Considerations

We develop our theory as follows. First, we provide an overview of the research stream on the different mechanisms for organizational governance -- such as vertical integration, partial equity ownership, joint ventures, and technology

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[1]The *agent* (or *agency*)refers to the independent organization that forms the downstream link between insurance *carrier*, and the insured in the marketplace for insurance services.

licensing -- to argue for conceptualizing 'electronic integration' as a specific form of quasi-integration that exploits emerging information technology capabilities. Subsequently, we discuss the role of transaction costs in the research stream on vertical integration. The impact of information technology in influencing transaction costs is explored next to develop a research model of critical determinants of electronic integration.

Mechanisms for Organizational Governance

In simple terms, the two traditional mechanisms for organizational governance are the *firm* (or the hierarchy) and the *market* (Coase, 1937; Williamson, 1975) -- where a firm is defined in terms of those assets that it owns or over which it has control (Grossman and Hart, 1986; see also Pfeffer and Salancik, 1978) and is engaged in transactions with other firms in the market. The firm coordinates the flow of materials through adjacent stages of a business process by means of rules and procedures established within the hierarchy. The market, on the other hand, coordinates the flow of materials between independent economic entities through the use of the price mechanism reflecting underlying forces of supply and demand. Taking the firm and the market as 'pure' forms, several intermediate governance mechanisms have been proposed over the years. These include: long-term relational contracts (MacNeil, 1980; Stinchcombe, 1990), joint ventures (Harrigan, 1988) and quasi-firms (Eccles, 1981) which can be more formally classified as either bilateral or trilateral governance (Williamson, 1985) or simply viewed as 'quasi-integration' (Blois, 1972). Collectively, these mechanisms are used by organizations to maintain control over critical resources necessary for their success (Pfeffer and Salancik, 1978; Thompson, 1967).

Within these governance mechanisms, vertical integration[2] has been an area of considerable research along multiple theoretical perspectives (see Perry, 1989 for a comprehensive review), but the transaction cost model (Williamson, 1975, 1985) is the dominant one (Walker, 1988). Hence, we discuss the role of transaction costs in vertical integration research next.

The Role of Transaction Costs in Vertical Integration Research

The general argument of transaction cost analysis is that vertical integration is preferred over market exchange when the sum of transaction and production costs of market exchange exceed those of hierarchy. Critical determining conditions for high transaction costs are environmental or transactional complexity and the existence of transaction-specific assets (Williamson, 1975, 1985, 1989; Klein, Crawford, and Alchian, 1978). Other environmental and behavioral considerations theorized to exacerbate transaction costs are information asymmetry due to bounded rationality, and opportunism combined with small numbers exchange. The general proposition relating transaction costs and governance mechanisms has been refined over the years with greater distinctions among the various types of asset specificity (transaction-specific know-how; site specificity; physical asset specificity; and dedicated assets), as well as a greater recognition of the existence and viability of *intermediate* mechanisms of governance (Williamson, 1985).

This theoretical proposition has been increasingly subjected to empirical research. For instance, constructs derived from this model have been adopted as the determinants of: backward integration (Monteverde and Teece, 1982; Masten, 1984; Masten, Meehan, and Snyder, 1989), forward integration into distribution (John and

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[2]Following (Perry, 1989), vertical integration is defined as a condition in which a firm "encompasses two single output production processes in which either (1) the *entire* output of the 'upstream' process is employed as *part or all* of the quantity of one intermediate input into the 'downstream' process, or (2) the *entire* quantity of one intermediate input into the 'downstream' process is obtained from *part or all* of the output of the 'upstream' process. "(p.185, italics in the original).

Weitz, 1988), preference for internal *versus* external suppliers (Walker and Poppo, 1990), sales force integration (Anderson, 1985; Anderson and Schmittlein, 1984), make *versus* buy in components (Walker and Weber, 1984), contract duration (Joskow, 1987) and joint ventures (Pisano, 1989). The empirical approach to transaction cost research has generally been one of assessing whether interfirm relationships conform to predictions from transaction cost reasoning. For the most part, there has been consistent empirical support for theoretical propositions drawn from the transaction cost framework.

Transaction Costs and Information Technology

Recent developments in information technology -- especially IOS (Barrett and Konsynski, 1982) -- have the potential to redefine the structural and competitive characteristics of the marketplace (Cash and Konsynski, 1985). More specifically, following Malone et al. (1987), information technology could be expected to give rise to three sets of effects:

(a) *electronic communication effect* -- through reduced cost of communication while expanding the reach (time and distance);

(b) *electronic brokerage effect* -- increasing the number and quality of considerations of alternatives, and decreasing the cost of transactions; in other words, there is reduction in search costs in the marketplace through lower transmission cost while reaching a higher number and quality of alternative suppliers. These effects lead to lowered costs of coordination between organizations in a market, thus reducing the transaction costs of exchange; and

(c) *electronic (process) integration effects* -- increasing the degree of interdependence between the set of participants involved in the business processes; this is more than the administrative costs of streamlining data entry across organizational boundaries, but includes the ability to interconnect adjacent stages of business processes (such as design, tooling and manufacturing) to be on an integrated platform.

However, the impact of these effects varies according to the specific form of IOS deployed -- which can be either a *common infrastructure* through a third-party system (i.e., ANSI X.12 standards) or a *unique, proprietary system* installed to develop and implement a firm-level strategy (e.g., Baxter's *ASAP* network or American Airlines' *SABRE* network). In the former case, the benefits cannot be differentially appropriated by a firm since its competitors have access to the same technological capabilities, while in the latter case the specific firm chooses to commit its strategic investments with the expectation of deriving firm-level advantages.

Let us explore the implications of such trends on the transaction cost perspective, where costs arise from search and information-gathering, and from writing, monitoring and enforcing contracts in an exchange relationship; these costs determine the form of a governance relationship between two organizations. Efficiency is compromised by information asymmetry and coordination costs, which are among the elements of transaction cost that are likely to be decisively influenced by the capabilities of computers and advanced communication technologies (Bakos and Treacy, 1986). Consequently, there is a compelling logic to consider the relevance of transaction costs as a theoretical anchor in understanding electronic integration.

In this vein, Clemons and Kimbrough (1986) argue that competitive advantage could result when the transaction costs in dealing with some competitors were reduced in an *asymmetric* manner. Thus, it is entirely possible for the deployment of a unique, proprietary (as opposed to a common) IT application to reduce the transaction cost for the particular dyad relative to other modes of exchange. Extending this logic, Clemons and Row (1989) enumerate a set of restructuring types that includes vertical integration. Indeed, their discussion of *virtual* forward integration in the case of McKesson, a drug distributor's network with its pharmacy customers is akin to our conceptualization of *electronic*

integration. They go on to offer a set of reasons for the emergence and benefits of this type of integration in the marketplace.

Thus, we argue that the concept of electronic integration and its determinants is fundamentally rooted in transaction costs that are impacted by IOS capabilities. Hence, we derive a set of hypotheses on the determinants of electronic integration drawn from the transaction cost model and empirically test them using two different samples of independent insurance agents electronically-interfaced through dedicated IOS in the commercial and personal lines respectively in the property and casualty segment.

Research Model

In this section, we translate the above theoretical considerations to the specific research setting. We describe the particular nature of electronic integration and identify its determinants, to develop a research model with a set of testable hypotheses.

Patterns of Electronic Interconnections in the Insurance Industry

The insurance industry in the USA is comprised of two major markets: (a) the life & health; and (b) the property and casualty (P&C) -- each with its distinctive set of products and channels of distribution. This study is concerned with the P&C insurance market, which offers protection against such risks as fire, theft, accident and general liability. The P&C market further breaks out into personal and commercial segments, the former covering individuals (automobile and homeowner insurance for example) and the latter indemnifying commercial policy holders against general liability and workers' compensation. The industry generated about $200 billion in

premiums in 1988[3]. In the two-part research design (to be discussed later), we focus on both segments.

While some carriers utilize 'direct writing', in which field offices deal directly with the customers, the distribution of commercial P&C insurance occurs principally through independent agents. These agents typically represent multiple carriers and are compensated on commission terms. However, there is a trend whereby independent agents rely exclusively on a single carrier or deal with a small number of carriers, thereby blurring the distinction between direct writing and the independent agency forms of distribution.[4] The upstream market is highly competitive since there are few barriers to entry and includes over 3600 insurance carriers. These conditions of fragmentation and low market power have resulted in intense price-based competition and a cyclical pattern, with marginal players exiting the market during industry downturns and entering at upturns. Approximately 300 carriers have multiple offices (Frost and Sullivan, 1984) and as many as 20 to 30 are major carriers accounting for about 50% of revenues. Downstream activities in this industry involving agents are similarly highly competitive.

Further, both the upstream and downstream activities are on the threshold of significant transformation along several dimensions: (a) *consolidation of agency operations*, reflecting a reduction in the number of independent agents by as much as 25% during 1980-86[5] to around 42,000; (b) *forward integration by carriers*, through mechanisms such as direct-writing, commissioned employee arrangements, and exclusive agencies; and (c) increasing *back-office automation* and *deployment of IOS* with carriers, with as many as 40% of all independent agents interfaced with at least

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[3] Standard & Poor's industry surveys: Insurance and Investment Banking.
[4] From interviews and background research by the authors.
[5] d'Adolf, *Independent Agent*, August 1987; p.27.

one insurance carrier[6]. These trends, taken together, highlight the need to set the role of electronic integration against a backdrop of fundamental transformations in the marketplace.

Common versus Unique Interfacing. Common standards for electronic policy information transfer between insurance carriers and the insurance agents have been set by the industry organization, ACORD, and in 1983, the Insurance Value Added Networks (IVANS) was established. Following the earlier discussion on transaction costs and information technology, we argue that the development and installation of common standards and a common network will favor the independent agents by creating the capability to interface with multiple, competing carriers. Specifically, the agents could reduce their dependencies on a narrow set of carriers, while exploiting the full benefits of electronic brokerage effects *en route* to the creation of an electronic market.

In contrast, the deployment of a unique (i.e., proprietary) IOS allows the focal carrier to more tightly couple its business processes with those of the agent and expand the scope of operations over which it can exercise control. This is akin to what Konsynski and McFarlan (1990) term an 'information partnership' which can confer benefits of scale without ownership. In other words, the deployment of unique IOS between a focal carrier and a set of independent agents is a form of 'vertical quasi-integration' (Blois, 1972), specifically termed here as 'electronic integration' that is more 'hierarchy-like' than 'market-like' (Williamson, 1985). Further, we argue that *within* the hierarchy-like governance mechanism of electronic integration there exists a continuum which ranges from agents that rely *exclusively* on a single carrier (approximating the pure hierarchical form of 'direct

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[6]ACORD Study on Interfacing the Insurance Industry (preliminary report), 1989.

writing') to those agents that deal with multiple carriers and depend to a lesser extent on any single electronically interfaced carrier.

An empirical assessment of the determinants of electronic integration should delineate (a) the focal unit of observation in the dyadic relationship; (b) the specific conceptualization of electronic integration; and (c) the set of constructs that are expected to explain the pattern of electronic integration. This is discussed next.

The Focal Unit of Observation

A fundamental issue in this research study is the identification of the focal actor that is making the integration decision. For example, when Monteverde and Teece (1982) contended that the specific assets (especially, human assets) play a significant role in 'internalizing' production, they focus on the integration decision of the two automotive firms. The specific argument is that "relying on suppliers for preproduction development service will provide the suppliers with an exploitable first-mover advantage" (1982; p 212) and vertical integration by the auto makers is, therefore, an efficient response to counter such potential opportunistic behavior. Similarly, Walker and Weber (1984) focused on a set of decisions relating to 'make or buy' of automotive components to predict the extent of vertical integration of an automaking firm. These studies -- typical of much of empirical work on transaction costs in vertical integration -- are concerned with a set of activities of one or more focal firm(s) to explain the level of integration within its boundaries.

If we were to adopt the same approach for the insurance industry, then we should look at one or more insurance carriers and evaluate their level of integration of activities such as reinsurance, rating or direct writing through the transaction cost lens. Such an effort would be a straightforward study of vertical integration in the insurance industry. However, our focus is on the role played by a specific IOS platform that allows a focal carrier to be interconnected with a set of independent insurance agents -- that were hitherto operating in a 'market-like'

mode but are now electronically-interfaced. Consequently, we evaluate the determinants of electronic integration of the insurance agents by focusing *only on those activities* that are carried out *via* this IOS.

Conceptualization of Electronic Integration

A stylized process of the electronic integration between a focal carrier and the independent agents is as follows[7]: Typically, the carrier initiates the process of deploying an IOS by offering it to a set of independent agents that distribute the carrier's products. In this industry, the initial hardware and software costs associated with these proprietary systems are generally borne by the carrier as an inducement to the agent to accept the system. The agent -- who as noted above is operating in a marketplace characterized by consolidation -- has to make a choice either to reject the system and continue to operate in a 'market-like' mode or accept the system and become more 'hierarchy-like.'[8] Subsequent to the interfacing decision, the agent invests resources (time and money) to develop *specific* capabilities to conduct their business processes via this system. This is complemented by technical and procedural advice and support from carriers. This creates procedural (specific know-how) as well as human asset specificity (through training for system use) relative to the carrier deploying the IOS. In order to prevent opportunistic appropriation of these specific assets, *the agent may attempt to safeguard these investments in transaction-specific assets by channelizing a greater share of the agency's business to the carrier*. This action makes it costlier for the carrier to terminate the relationship.

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[7]It is important to underscore that the transaction cost logic does not delineate a 'process model'. Given the complexity of the various transaction cost determinants, some directly attributable to the insurance carrier and others to the insurance agents, we provide a stylized description of the process of the choice of the governance mode, i.e. electronic integration. The empirical tests, however, follow the governance choice under static equilibrium and is consistent with prior work in this area.

[8]This study is not concerned with the agents' decision to either accept the interfacing system or not. Since not all agents routinely accept the interfacing system, an interesting research area is to develop a model that explains and predicts the *acceptance* of the interorganizational system.

This situation is somewhat analogous to the franchising system -- where franchisees may be required to commit investments in transaction-specific capital, such as renting land from the franchiser, making it costly for the franchisees to terminate the agreement (Klein, 1980) termed a 'hostage' situation (Williamson, 1985). In this setting, the insurance carrier provides the IOS (usually bearing most of the hardware, software and setup costs) which compels the agent to invest in specific assets related to the customization of business processes. This *ex-post* 'hostage' situation subsequently requires that the agent channelize more business to the IOS-linked carrier.

In a similar vein, Heide and John (1988) argue that for a manufacturer's agency dealing with a large principal, substantial transaction-specific assets may be created by the agency (such as specific training, and knowledge of the principal's products, policies and procedures). In such a case, the theoretically-predicted option of vertical integration to safeguard specific assets is "simply irrelevant...because small agencies cannot consider vertical integration as a feasible alternative" (p.21). The explicit recognition of the perspective of the smaller firm in the dyad distinguishes the present research from studies on the unilateral integration decisions of large companies in industries such as automobiles (Monteverde and Teece, 1982; Masten et al. 1989) or aerospace (Masten, 1984).

Given our focus on the independent agents making the governance decision, we conceptualize electronic integration as the *percentage of business directed to the focal carrier through the hierarchy-like electronic channel.* This is consistent with: (a) John and Weitz (1988), who view forward integration as "percentage of direct sales to end-users" (p 345); and (b) Masten et al (1989), who conceptualize backward integration as "the percentage of company's component needs produced under the governance of the firm" (p 269). This conceptualization is superior to the more traditional dichotomous 'market' *versus* 'hierarchy' categorization increasingly

bypassed by researchers in favor of predicting higher or lower points on a continuum between these two pure forms (e.g. Pisano, 1989).

Determinants of Electronic Integration

In this section, we identify a set of constructs consistent with the transaction costs model as critical determinants of electronic integration.

Asset Specificity. This is a dominant source of transaction costs since asset specificity transforms the transaction context into a small numbers bargaining situation. Within the various sources of asset specificity (Williamson,1985), we argue that human asset specificity, exemplified by specialized training and learning, is an important source of asset specificity in service operations, such as insurance. Anderson (1985) considered specialized human knowledge as reflecting asset specificity in sales operations, which is similar to the extent of customization of carrier-specific procedures for electronic interfacing carried out by the insurance agent. In a similar vein, John and Weitz (1988) in their research on distribution channels noted that the most relevant form of asset specificity in this context is the level of training and experience specific to the product-line.

Further, it is clear that unique IOS such as the well-known ASAP system of Baxter Healthcare (previously, American Hospital Supply Corporation) embody "features built into the...system to customize the system to a particular hospital's needs, in effect creating a *procedural asset specificity* in the relationships between the buyer and seller" (Malone et al., 1987; emphasis added). In addition, these proprietary systems create technological asset specificity akin to dedicated assets since they cannot be easily shifted to work with other insurance carriers. Thus, the implementation of a carrier-specific IOS creates non-redeployable specific asserts (human, procedural and technological) that are costly to switch to a new carrier in a market-like exchange; consequently, the market safeguard is not effective. To safeguard against the possibility that the insurance carrier may not treat the agent

preferentially, we expect that the agent to channelize more business to the interfaced carrier, *ceteris paribus*. We formally hypothesize that:

H1: Asset Specificity will be positively related to the degree of electronic integration.

Product Complexity. A major element of complexity in the transaction cost context is the level of complexity of the product (Anderson, 1985; Malone et al. 1987; Masten, 1984) handled in the transaction. Product complexity in the property and casualty insurance context is best highlighted by the differences between personal and commercial lines. In general, personal lines are relatively standardized, partly due to regulation and partly due to intrinsic features (such as a relatively limited number of options on auto or homeowners' insurance). Commercial lines, in contrast, consist of products used by agents to insure businesses. Such insurance requires the processing of several hundreds of thousands of variations of coverage options by tailoring the product offering to the specific requirements of the business, resulting in a highly complex set of products and processes.

Products of high complexity require more information exchange between organizations or units involved in completing the transaction. As Malone *et al* (1987) noted, "buyers of products with complex descriptions are more likely to work with a single supplier, in a close, hierarchical relationship..." (p.487). Theoretically, due to relatively high transaction costs, such complexity embodied in the commercial lines is more efficiently handled within a 'hierarchy-like' mode under *ceteris paribus* conditions. Thus, our hypothesis is:

H2: Product complexity will be positively related to the degree of electronic integration.

Trust. One of the major underlying behavioral dimensions in the transaction cost perspective is opportunism, defined as 'self-interest seeking with guile' (Williamson, 1975, 1985). Williamson (1975) contrasts opportunism with "stewardship behavior", which "involves a trust relation" (p.26). Trust can be

viewed as the obverse of opportunism (Jarillo, 1988), and a relationship based on a higher level of trust will be less subject to potential opportunistic behavior than one with lower levels of trust.

The implementation of this IOS has been accompanied by the granting of underwriting authority to these agents. Agents differ in their levels of underwriting authority. Indeed, subsequent to the installation of the system, the focal carrier has granted or increased underwriting authority to most electronically-interfaced agents. This authority implies that agents are able to complete the full circle of quoting, underwriting and issuing policies without reference to and approval from the focal carrier. In contrast to non-interfaced systems, the IOS allows the focal carrier to exploit the functionality of the system to maintain an 'audit trail' of the steps carried out by the agent to underwrite a particular insurance policy. While this functionality provides a mechanism for the focal carrier to delegate underwriting authority, the independent agent has no basis to ascertain the degree to which its actions are monitored relative to other electronically-integrated agents. Thus, the level of underwriting serves as an indication of the trust that exists in this relationship and further induces the agent to act in a 'hierarchy-like' mode rather than in a 'market-like' one. We propose the following hypothesis:

H3: Trust will be positively related to the degree of electronic integration.

Agent Size as a Control Variable

Size has been a prominent variable in industrial organization economics (Scherer, 1980) and has an effect on vertical integration. Thus, in this research we could argue a positive effect between size and electronic integration. However, with our focus on the independent insurance agent, it is difficult to argue that the larger agents will be electronically integrated with a single insurance carrier (Stern and El-Ansary, 1977). This is because such an integration could weaken their ability to serve a variety of market segments as 'independent' agents. The role of asymmetric firm

size has not been addressed within the theoretical formulation of the transaction cost framework (Osborn and Baughn, 1990) although, as discussed, researchers (Heide and John, 1988) have pointed out that for a small agency dealing with a large principal vertical integration may not be a viable option to safeguard specific assets. Thus, in our model, we specify size as a control variable and expect, *ceteris paribus,* that the relatively larger agents are less likely to be electronically integrated.

Methods

The hypotheses are tested in a two-part design using two independent samples: (a) 143 property and casualty (P&C) insurance agents involved in the *commercial* lines business -- who are interfaced with a single focal carrier *via* a dedicated IOS; and (b) with a random sample of 64 independent agents interfaced with insurance carriers for *personal* lines business. The second setting is to cross-validate *some* of the key results of the first setting in a complementary approach to increase the robustness of the findings. Since the design parameters of two parts are not the same, we discuss the methods and results for each part separately.

Part One: Electronic Integration in the *Commercial* Lines Segment

This research setting is characterized by the following conditions: (a) the deployment of an IOS by a focal carrier to a set of independent agents; (b) improved information flows, better monitoring and control capabilities, and reduced cost of policy processing enabled by IOS deployment; and (c) a sample of a random set of agents electronically-interfaced with *this* focal carrier.

Data. A structured questionnaire reflecting the measures of the key constructs was mailed to all 321 agents of a focal insurance carrier that had deployed an IOS as of July, 1988. Complete data were obtained from 143 agents, representing a response rate of 44.5% -- considerably higher than the 20% in Etgar's (1976) study of the P&C market.

Informant. A major area of controversy in research on organizational-level phenomena relates to the identification of appropriate 'informant' for measuring organizational properties. With the objective of minimizing key-informant bias (Bagozzi and Phillips, 1982), we sought to identify knowledgeable informant(s) as well as assess the need and benefits of multiple informants during the initial round of interviews. As most agencies are owner-managed, we chose the owner as our only informant since no other person has the vantage point for providing the data relevant for this study. This approach is consistent with the general recommendation to use the most knowledgeable informant (Huber and Power, 1985; Venkatraman and Grant, 1986); as well as the research practice of relying on a single senior-level informant in studies involving small organizational units (see for instance, Daft and Bradshaw, 1980). The mean insurance agency had a total personnel size of 26 and annual commercial premium of $5.8 million supporting our contention of the validity of reliance on a single, senior-level informant.

Measures. We briefly describe our approaches to operationalize the constructs in the first part of the study.

Electronic Integration. As mentioned earlier, the degree of electronic integration is operationalized as 'the percentage of commercial line business, in dollar premium terms, accounted for by the focal carrier.'

Asset Specificity. Consistent with our theory, we focus (in this part of the study) on human asset specificity. The complexity and the unique features embedded in the IOS requires either dedicated personnel for dealing with the carrier or specialized training of operators. Further, effective exploitation of the IT capabilities requires higher levels of participation for planning and implementing the new, unique set of procedures. Thus, we measured human asset specificity by summing three dichotomous questionnaire items: (a) the presence of a dedicated IOS operator, (b) emphasis on training for IOS operation and (c) the involvement of

operators in system planning and implementation. Thus, the value for the measure ranges from 0 to 3.

Complexity. This construct could be measured in many different ways including a measure capturing the perceived complexity of the product by the agent. Given our focus on an organizational-level construct of product complexity, we decided to measure this as 'the percentage of commercial line business' within the agent's portfolio as this is a good surrogate for the level of complexity. Within the industry, we found widespread acknowledgement that commercial lines are much more complex than personal lines.

Trust. The level of trust is operationalized as the extent of underwriting authority given to the agent. Since this function is perhaps the most critical aspect of the insurance process -- hitherto under the control of the carrier -- the extent of underwriting authority delegated is an appropriate measure for the trust placed by the carrier with the agent. Four levels of underwriting authority from the questionnaire serve as the measure.[9]

Size. Size was operationalized as an 8-level categorization based on total premiums.[10]

Analysis. The basic equation for the test of hypotheses is as follows:

$$EI = \alpha_0 + \alpha_1 \text{ Trust} + \alpha_2 \text{ Asset Specificity} + \alpha_3 \text{ Complexity} - \alpha_4 \text{ Size} + \varepsilon \quad (1)$$

where, EI=degree of electronic integration and the other concepts are as discussed above. Since the dependent variable is bounded between 0 and 1, a standard set of OLS estimators is biased (Judge *et al.*, 1980). Consistent with Caves and Bradburd (1988) and Masten et al (1989), the dependent variable was transformed into the form: $ln[EI/(1-EI)]$ for estimation purposes.

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[9]The exact measure was a four-level categorization of the dollar amount of the underwriting authority limit granted to the specific agent by the focal carrier: *None, Less Than $500,000, $500,000-$1,500,000, and Greater Than $1,500,000.*

[10]The categories ranged from *"Below $750,000 per year"* to *"Over $15 million per year."*

Results. Table 1 summarizes the zero-order correlations among the variables.

Table 1: Zero-Order Correlations (n=143)

Variables	Mean	Sd	EI	Complexity	Asset Specificity	Trust	Size
EI	56.0	34.2	1.00				
Complexity	72.6	15.8	-.31**	1.00			
Asset Specificity	1.70	1.15	.10	-.08	1.00		
Trust	4.78	2.34	-.30**	.17*	-.34**	1.00	
Size	5.69	2.5	-.59**	.35**	-.12*	.05	1.00

* p<.05; ** p<.01;

Determinants of Electronic Integration. Table 2 summarizes the results of estimating equation (1). The regression equation was significant (F value: 16.78, p<.01), and explained approximately 30% of the variance in EI. However, the hypotheses relating to asset specificity and product complexity were not supported. Further, the hypothesis relating to trust (H3) emerged significant in the direction opposite to the one hypothesized, and size -- introduced as a control variable -- emerged as negative and significant (α_4 = -0.527; t-value: 7.17) as expected.

Table 2: Model Estimation (Equation 1)

Coefficient	OLS Beta Estimates (t-value)
α_1 (Trust)	-0.1292 (-1.75)*
α_2 (Asset Specificity)	.025 (.345)
α_3 (Complexity)	.008 (.119)
α_4 (Size)	-.527 (-7.17)**

** p<.01; * p<.10

The lack of support for the hypothesized determinants of electronic integration, especially those relating to asset specificity and product complexity, is important. The results are particularly interesting in the light of the strong theoretical rationale from the transaction cost framework for expecting these variables to predict electronic integration, as well as previous empirical work (Anderson, 1985; John and Weitz, 1988; Caves and Bradburd, 1988; Masten et al,

1989) which has generally yielded statistically significant relationships in the hypothesized direction.

The coefficient for trust was, contrary to the hypothesis, negative and significant, implying an inverse relationship between trust and electronic integration. This seemingly contradictory finding can be partly explained if we recognize that underwriting authority is highly coveted by agents (due to the control and authority over the entire business process of writing and issuing the insurance policy), and the focal carrier could be employing the grant of underwriting authority as another mechanism of 'quasi-integration'. Thus one could argue that agents that already have a high share of business with the carrier (i.e., high levels of electronic integration) are less likely to be provided with this incentive. Alternatively (as we elaborate later) it could be that the monitoring functionalities embedded within the IOS enable the focal carrier to entrust underwriting authority to even the less electronically-integrated agents. In the discussion below, we suggest that the latter explanation is more compelling. However, in the absence of intertemporal data on changes in electronic integration and trust, we cannot discriminate among such competing explanations except in a speculative manner.

Limitations and the Need for Cross-Validation. The generalizability of these empirical results, especially the absence of effects of transaction costs determinants is limited by the use of a single dataset and first-cut operationalizations of the constructs. The robustness of results could be increased if at least parts of the model are replicated in a complementary setting. To achieve this objective, we discuss below tests carried out in a second setting using a random sample of 64 independent agents electronically-interfaced with carriers for *personal* lines business.

Part Two: Electronic Integration in the *Personal* Lines Segment

This research setting is characterized by the following conditions: (a) the deployment of electronic interfacing systems by several carriers to independent

agents; (b) improved information flows and reduced costs of policy processing enabled by interfacing ; and (c) a sample composed of a random set of 64 electronically-interfaced agents that provided the required data for this research.[11] For each agent we consider the degree of electronic integration with the major carrier with whom the agent is interfaced *via* a proprietary IOS.

Measures. We briefly describe our approaches to operationalize the constructs for this part of the study.

Electronic Integration. Consistent with the first part of this study, the degree of electronic integration is operationalized as 'the percentage of personal line business, in dollar premium terms, accounted for by the focal carrier.'

Asset Specificity. The measurement of asset specificity is an improvement in this part of the study since we could differentiate among three important dimensions of asset specificity: (a) technological asset specificity; (b) procedural asset specificity; and (c) human asset specificity. Each dimension is measured using multi-item interval scales. Table 3 summarizes the measures and indicates the Cronbach α reliability indices. The values of α range from 0.66 to 0.89, well beyond the generally-accepted threshold for research. Further as can be seen in Table 4, the correlations among them are low, implying discriminant validity. The highest correlation is .69 between procedural and technological asset specificity, which is to be expected given the role of the technological platform in customizing the procedures to the requirements of the focal carrier. A formal test of discriminant validity using the structural equation modelling approach (see for instance, Venkatraman, 1989)

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[11] We thank the researchers concerned for their generous gesture in providing data for this part (in order to preserve anonymity, we have not provided the reference at this stage). From a dataset of 747 agents of whom 312 were electronically integrated, we selected a random sample of 64 who provided the data necessary to carry out the analyses. Based on descriptive data on the positions of the 'informants' we ascertained that 85% of this data is based on responses provided by the owner/president. Further, the larger study was conducted under the auspices of a leading industry association, whose members stand to gain directly from the research results, thereby increasing confidence in the quality of the data.

involves establishing that that the three dimensions are pairwise correlated at values less than 1.0. Tests using LISREL VI (Joreskog & Sorbom, 1984) indicated that the three dimensions are indeed different (χ_d^2 (df:3) = 44.42, p<.01). More specifically, a test that the dimensions of procedural and technological asset specificity are different yielded the following statistics: χ_d^2 (df:1) = 3.34, p<.07, providing modest support for discriminant validity.

Table 3: Details of Constructs and Measures in Sample Two

Construct	# of Items	Description of the Measures	Cronbach's α
Technological Asset Specificity	3	(i) Dedicated (leased) line or Dial-up, Dedicated Company Terminal or Not (3- level measure); (ii) System not easily compatible with interfaces offered by other carriers; (5-point scale; Agree/disagree) (iii) Interfacing equipment we have can only be used to interface with a single company. (Agree/Disagree, 5-point scales)	0.66
Procedural Asset Specificity	3	(i) We do not want our people to spend their time learning the operation of yet another interface; (ii) We experienced problems and it took us a while to become fully operational with the existing interface; (iii) We have changed our operating procedures in order to work with the existing interface. (all measured using a 5-point scale Agree/Disagree)	0.89
Human Asset Specificity	2	Sum of the Ratios of (i) No. of Employees Trained in System Operation to Total Employees; and (ii) Dollar Cost of Interfacing per Employee.	0.83

Analysis

The basic equations for the test of hypotheses is as follows:

$$EI = \beta_0 + \beta_1 \text{ Tech-Asset Specificity} + \beta_2 \text{ Procedural-Asset Specificity} + \beta_3 \text{Human Asset Specificity} - \beta_4 \text{ Size} + \varepsilon \quad (2)$$

Results

Table 4 summarizes the zero-order correlations among the variables used in part two:

Table 4: Descriptive Statistics and Zero-Order Correlations (n=64)

Variables	Mean	Sd	EI	Technological Asset Specificity	Procedural Asset Specificity	Human Asset Specificity
EI	40	22.5	1.00			
Technological Asset Specificity	2.36	1.26	-.067	1.00		
Procedural Asset Specificity	2.32	1.50	-.134	.69**	1.00	
Human Asset Specificity	0.45	0.44	.011	.12	.21	1.00

** p<.01;

Impacts of the Three Dimensions of Asset Specificity on Electronic Integration. Table 5 summarizes the results of estimating equation (2). In contrast to the estimates of equation (1), the regression model was *not* significant (F value: 0.715, ns), and explained less than 5% of the variance in EI. While the breadth of the explanatory variables is less than equation (1), this model included three different dimensions of asset specificity, a key concept within the transaction cost perspective. None of the three coefficients emerged significant, thus providing consistent support to reject H1, as in part one.

Table 5: Model Estimation (Equation 2)

Coefficient	OLS beta Estimates (t-value)
β_1 (Technological Asset Specificity)	.1323 (0.706)
β_2 (Procedural Asset Specificity)	-.2020 (-1.126)
β_3 (Human Asset Specificity)	-.0139 (-.101)
β_4 (Size)	-.180 (-1.251)

Summary

Table 6 summarizes the results, which highlights that the hypotheses are consistently not supported across the two-part design. It is important to note that the central hypothesis (H1) relating to asset specificity *did not* receive empirical support across multiple operationalizations and datasets.

Table 6: Support for Hypotheses

Hypothesis	Relationship	Result in Part One	Result in Part Two
H1	Positive Effect of Asset Specificity on EI	Not Supported	Not Supported
H2	Positive Effect of Product Complexity on EI	Not Supported	[Not Tested]
H3	Positive Effect of Trust on EI	Not Supported	[Not Tested]

Discussion

This research study sought to develop a research model of electronic integration based on a set of constructs rooted in transaction costs. The underlying rationale was derived from: (a) prior the use of transaction cost perspective to test patterns of vertical integration (see Walker, 1988; Perry 1989); and (b) the role of information technology in influencing transaction costs with the expectation of restructuring economic organizations (Bakos and Treacy, 1986; Clemons and Row, 1989; Malone *et al*, 1987). The latter set of arguments, although intuitively appealing, have not been empirically tested. The results of this study provide no support for

the hypotheses and we offer below some possible explanations with a view to guiding future research on the important theme of electronic integration.

Possible Explanations Due to the Distinctive Features of Electronic Integration

One obvious explanation for the results could lie in the distinction between the general concept of vertical integration and the particular concept of electronic integration. Thus, while prior studies have consistently demonstrated positive effects of transaction cost determinants (such as complexity and asset specificity) on the levels of vertical integration, it is possible that in the context of *electronic* integration, the I.T. capabilities inherent in the IOS act to mitigate the traditional determinants of transaction cost. In other words, the superior information processing and monitoring capabilities embedded in the *carrier-specific* inter-organizational system has enhanced quasi-integrated, vertical, hierarchical relationships without increasing the degree of vertical integration. While we would expect such a result in a setting with a *common* platform for information-exchange, it is particularly surprising in the settings characterized by *proprietary* systems in both samples. Indeed, the results call for a greater attention to the functionalities of the IOS beyond a simple 'common *versus* unique' categorization in developing theoretical hypotheses pertaining to the role and effects of IOS.

We speculate that it is the functionalities of the system in these *specific* settings that act to moderate the determinants of transaction cost. Information impactedness, a traditional determinant of transaction costs could be mitigated through better information access, and quicker and 'seamless' communication between insurance carrier and the electronically-integrated agents. In this line of reasoning, risk evaluation capability -- enhanced significantly through expert system functionality -- could mitigate the transaction costs arising due to product complexity. Thus market modes for commercial lines may not be inefficient

compared to products of lower complexity due to the minimization of market 'frictions.'

However, it appears counter-intuitive to suggest that asset specificity is reduced as well, given the high levels of procedural specificity and human asset specificity (training) that is implied with the the installation and operation of carrier-specific IOS. On the other hand, it is conceivable that the level of carrier-specific training required for using an IOS may be *both low and relatively standard across governance modes* such that it may have insignificant differential effects on the level of electronic integration. It is also possible that the functionalities of expert systems built into the IOS could reduce human asset specificity at the level of the agency, resulting in minimal impact on the level of electronic integration. It may be a situation of training an operator within the agency -- who has never worked with a computer-based system -- to become conversant with the policy-processing system; once familiar with the system, the operator may find it relatively easy to move across such systems. If such a step function is indeed the case, it is important for future research studies to develop richer measures of asset specificity as well as decompose it into components that are related to the general technology platform and are specific to a carrier. Lower requirements of asset specificity may not convert the transacting situation into a small numbers bargaining one, making it relatively more attractive to conduct transactions in 'market-like' modes of governance.

Opportunism may also be attenuated by the 'mutual hostage' situation (Williamson, 1985) in which the carrier too has made transaction-specific investments in the form of: (a) training the agent to operate the system as well as providing considerable technical support in the early stages of interfacing; and (b) non-redeployable expenses (i.e. sunk costs) associated with the installation of the hardware and the communications architecture at the locations of each agent. Thus, the carrier has *reciprocally* invested in transaction-specific assets with the agent, and

this reciprocity may serve to reduce transaction costs. This situation of *co-specialized assets*, ones that are most valuable when used together (Klein, Crawford and Alchian, 1978) may require a specification of the degree of co-specialization in a particular transaction relationship rather than an evaluation of the asset specificity of any one of the parties in isolation.

Alternatively, the agent may have employed other means of safeguarding transaction specific assets than increasing the degree of electronic integration. Such means of safeguarding transaction-specific assets for the agent could include 'dependence-balancing' actions such as improving relationships with clients (Heide and John, 1988). An interesting direction for future research is to investigate the forms of safeguarding transaction-specific assets and their effectiveness in the context of electronic integration. Thus, a major research challenge is to go beyond the current level of speculation of economic reorganization *via* information technology to examine at a finer level of detail the theoretical relationships in interorganizational governance mediated by interorganizational information systems.

Normative Theory *versus* Current Practice

It is also important to recognize that the theoretical underpinnings of transaction cost analysis are normative, while empirical tests (such as this study) are based on current practice. To the extent that the inefficient modes of governance have not been eliminated and the mode of governance is not in equilibrium across the entire setting, the model estimation may not conform to the normative theory. Disequilibrium is a possibility in the insurance industry which has recently been undergoing major transformations including: (a) widespread 'downsizing' and restructuring (including the elimination of regional offices) within insurance carriers; and (b) significant reduction and consolidation among the community of insurance agents. Such dynamic conditions in the industry and in its governance

structures suggest a possibility of disequilibrium at the time data were collected for this research. Further, we are witnessing a reassessment on the part of several insurance carriers of the value of proprietary IOS versus common industry platforms.[12] This could be due to the ineffectiveness of these IOS to shift transactions away from the traditional 'market-like' modes in the insurance industry. Thus, given the relative recency of leveraging IOS to reorganize economic activity, coupled with the turbulent conditions in the industry, empirical data may not support the strong normative efficiency arguments underlying the transaction cost model.

'Theory-Constrained' *versus* 'Theory-informed' Models

This study developed a model of electronic integration that was largely rooted in one dominant theoretical perspective. While it is useful to test the applicability of the best available theory to a new phenomenon (namely, electronic integration between firms), an alternative is to develop a research model that is based in a larger theoretical base than a single theory. Other promising approaches include organizational theoretic perspectives, such as resource dependency (Pfeffer and Salancik, 1978), industrial organization economics, especially those dealing with entry and mobility barriers as well as game theory. Such an approach would result in a phenomenon being explained and/or predicted by a set of determinants from multiple complementary theoretical perspectives. Such 'theoretical pluralism' may be particularly apposite since while the transaction cost model has received strong empirical support for the 'pure' governance forms, it has been shown to be limited (Milgrom and Roberts, 1988; Klein, Frazier, and Roth, 1990; Robins, 1987) especially in terms of its ability to explain intermediate modes of governance. Further, the idea that the effect of the determinants of transaction costs in non-hierarchical relations

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[12] *New York Times*, June 28, 1990.

can be mitigated under certain conditions has recently been gaining conceptual and empirical currency.

Jarillo (1988) noted that the network form of governance between firms was analogous to Ouchi's (1980) concept of clans in a hierarchy. In both modes, opportunism is tempered, the time horizon is lengthened and transaction costs lowered. While clans mitigate conditions of high uncertainty through a strong organizational culture, Jarillo suggests that trust relations can be purposefully forged between firms engaged in long-term relationships in a network governance form (see Sabel, Kern and Herrigel, 1989; Powell, 1990). Game theoretic concepts also support the notion of cooperative behavior in the case of repeated games (Kreps and Wilson, 1984); recurrent exchange is similar to an infinite horizon game. Reputation effects also moderate the incentive to behave opportunistically. Thus, given fundamental shifts in the organization of economic activity (Piore and Sabel, 1984; Sabel *et al.*, 1989; Powell, 1990) it is myopic to be limited to any single theoretical approach. We call for a greater attention to the development of models of phenomena that are 'informed' but not necessarily 'constrained' by any single theoretical perspective.

Research Design Extensions

While the above issues focused on theoretical considerations, future research should address some of the complementary research design extensions. Two are particularly important:

One: Use of a Control Group. Our design falls within the category of 'posttest only' (Campbell and Stanley, 1963) which is limited in its ability to rule out several competing explanations. Follow-on research is underway that explicitly incorporates a 'control group' of agents that do not have the functionalities offered by IOS (matched for equivalence on key criteria) and a 'treatment' group of agents that have

the functionalities of IOS to specifically test the determinants of electronic integration.

Two: Pre- versus Post- interfacing. Since the deployment of IOS is relatively new in many markets, a powerful design would be to adopt a pre- versus post-design to assess the change in the level of electronic integration as well as its determinants and effects. This could help, for example, to understand the negative relationship between trust and electronic integration observed in the first part of this study. Other key research questions that can be addressed within such a design include: (a) a clearer delineation of of the forces underlying the shift from one governance mechanism to another; and (b) a precise calibration of the *changes* in asset specificity as well as other determinants of governance mechanism as a direct result of the deployment of IOS.

Conclusions

This paper developed a set of hypotheses on the determinants and effects of electronic integration that were rooted in the transaction cost framework and were tested in two different samples of independent insurance agents in the property and casualty segment. The results provide no support for the transaction cost determinants, raising the possibility that the availability of sophisticated information processing capabilities could mitigate the transaction cost effects. Some explanations for the counter-intuitive results are noted in the hope of motivating further research into the important area of identifying determinants of electronic integration.

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